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*Beech Utilization Series No. 18*

# Beech for Turning

*by*

*Charles R. Lockard*

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EXPERIMENT STATION

**Northeastern Technical Committee  
On The Utilization Of Beech**

**in cooperation with**

**Northeastern Forest Experiment Station  
Forest Service, U. S. Dept. of Agriculture**

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## FOREWORD

The wood of the American beech tree (Fagus grandifolia Ehrh.) is well suited for a large number of uses, and it is rather widely used by manufacturers. Yet the amount used is not in proportion to the amount that grows in our northeastern forests. The utilization of beech--both in the woods and in the factory--has been recognized as a problem.

One reason for this is in the nature of the wood: it has a reputation for being difficult to season. Another is that many of the beech trees in our forests are of poor quality. And there are some plain prejudices against beech.

Research is finding ways to utilize beech as efficiently as any of the other comparable hardwoods can be handled. Considerable information about beech has been gathered. Yet most of this information is available only in fragmentary form in scattered technical reports. Some of it has never been published.

To study the problems of putting beech to the uses it deserves, and to promote the better management of the forests in which it grows, a Northeastern Technical Committee on the Utilization of Beech was organized in 1949. This committee, which includes representatives of Federal and State forestry agencies, universities, and state experiment stations, decided to assemble and publish the available information about the utilization of American beech.

As its part of this cooperative project, the Northeastern Forest Experiment Station has undertaken to edit, publish, and distribute the series of reports that will contain this information.

The subjects of these reports will be as follows:

\*Physical and mechanical properties of American beech.

(CONTINUED ON INSIDE OF BACK COVER)



# Beech for Turning

by

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**B**EECH is a wood eminently suitable for turning on a lathe. Betts (2) states that "the properties of the (beech) wood fit it for a number of special uses, such as food containers, chair stock, turned goods such as small handles and spools, laundry appliances, and many articles classed as woodenware and novelties." McIntire (5) characterizes beech wood as having good color, texture, and smoothness of surface when machined and "equal to or superior to (yellow) birch or (sugar) maple for turnings."

## THE PLACE OF BEECH IN TURNING

That wood turners and beech are not strangers can be shown by an analysis of the latest information on wood used in all manufacturing processes (6). Although the data were compiled in 1948, it is believed they still show current relationships reasonably well. In 1948, manufacturers of wooden goods used about 5 billion board-feet of native hardwoods of all species for a great variety of purposes. Of this amount, about 2 billion feet was used in 38 broad classes of items

involving turnings: furniture, handles, dowels, skewers, novelties, and so on.

Of the total hardwood used for items involving turning in 1948, about 6 percent was beech. But the general trend in beech use is upward. In the 15 years between 1933 and 1948, the use of beech *for all purposes* doubled. Betts (2) attributes a great deal of the increased use for turning to the "excellent turning properties for small articles made with a lathe." Between 1940 and 1948 alone, the quantities of beech taken for uses involving turnings increased 60 percent. There are no data to show what happened since then, but there is no reason to believe that use for turning is less and every reason to believe it is greater. At least it should be, if experience can be used as a guide.

#### RATING OF BEECH AS A TURNING WOOD

##### Survey Findings

Woods from many sources, including some from the Tropics, are used commercially for turned goods. Some manufacturers say that with properly prepared stock and proper machine technique, any wood can be turned satisfactorily. To determine the industry viewpoint on beech as a turning wood, the Wood Turners' Service Bureau<sup>1</sup> conducted an opinion survey among its members in 1950. Thirty-four manufacturers, located chiefly in the Northeast and Midwest, and consuming about 40 million board-feet of lumber, responded. Of these, three-fourths indicated that they used beech to some extent. These three-fourths, though, processed about nine-tenths of the volume handled by the group; and beech represented one-fifth of the lumber they consumed.

Each member was asked to express his opinion about beech as a turning wood. Even though the questions were both general and specific, such a survey has a weakness: individuals may develop their answers from entirely different viewpoints or on a different basis. Some having had wide experience with beech may have worked out any difficulties in its use and, therefore, look upon the species favorably. Others having used beech only occasionally may never have become fully proficient in its use; they may give beech an unfavorable rating. More important, some may have based their rating on

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<sup>1</sup>Wood Turners' Service Bureau, Statler Building, Boston 16, Mass.

the technical quality of the wood, while others may have considered all the problems incident to the procurement, seasoning, finishing, and storage of a wood generally considered as low grade and refractory. Some opinions may have been colored by the fact that white birch, the king of turning woods, was available to them. Still others, not familiar with this prime species, may have compared beech with species having generally similar technical characteristics, such as yellow birch or sugar maple. All of this background must be considered in viewing the composite of the information supplied on the rating of beech for turning.

Figure 1 represents a composite of the reports of the 34 respondents to the Bureau's request for information. The vertical break in the chart indicates acceptability, a rating of fair or better. On the basis of acceptability, beech ranks third among the woods listed. On the basis of a "good" rating, beech is fifth, being topped by paper birch, yellow birch, sugar maple, and black birch, in the order named.

The information on beech was further analyzed to see if there was a difference in rating due to locality; it is pos-

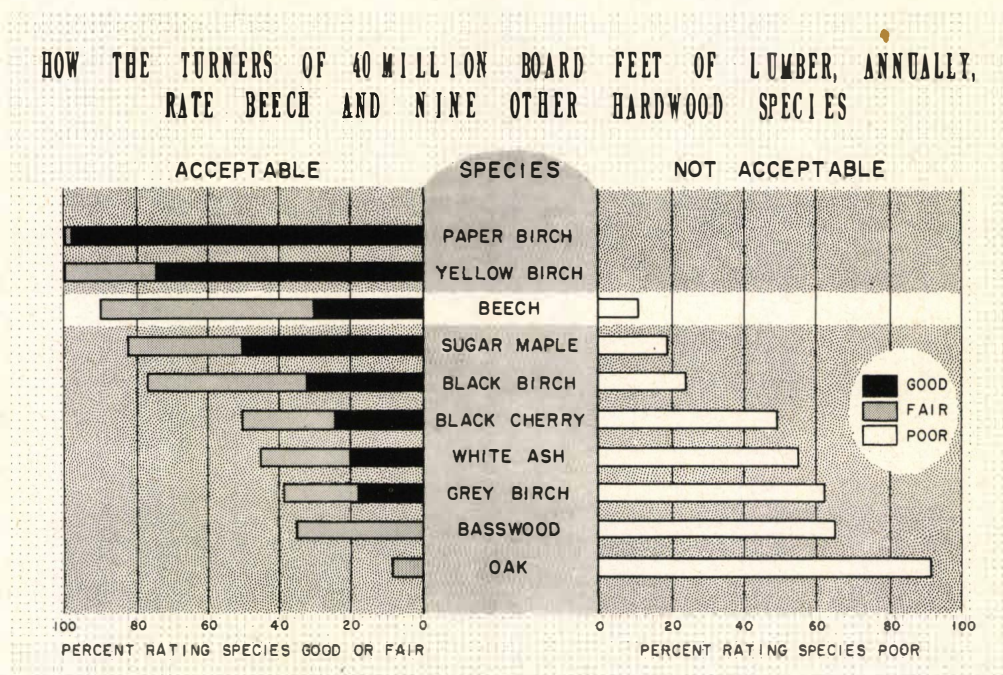


Figure 1.--Turnability rating of beech and nine other hardwoods based on an opinion survey conducted in 1950 by the Wood Turners' Service Bureau.



sible that those in the Northeast might be prejudiced against other woods because of the fine working qualities of the paper birch available to them. This analysis showed that 89 percent of the Northeastern operators and all of the Midwestern operators gave beech a rating of acceptable. However, there was a considerable split between the fair and good ratings; only 16 percent of the Northeastern group rated beech good, while it was rated good by 70 percent of the Midwestern group.

### Two Technical Studies

Because of the possible weakness of an opinion survey, a search was made of literature for controlled tests designed to isolate the primary technical facts about the turning of beech. Two series of studies were found. One series was

Table 1.--Comparative turnability of beech,  
yellow birch, and sugar maple

Species	Michigan State College tests	Forest Products Laboratory tests
Beech	100	100
Hard maple	94	90
Yellow birch	94	91

made by the U.S. Forest Products Laboratory in Madison, Wis. (3), the other by the Forestry Department of Michigan State College (7). These studies involved the manufacture of sample turnings under a range of moisture-content conditions on various types of lathes (fig. 2). Woods used included only beech, yellow birch, and sugar maple. The results of this research, with beech rated as 100, are shown in table 1.

### ACCEPTANCE OR REJECTION OF BEECH

Beech rates high with most turners; still, it is interesting to note the difficulties experienced by those who classed it as not acceptable. In the first place, beech must be used for the correct type of turning, as judged by the character of the wood--hardness, smoothness, ability to give

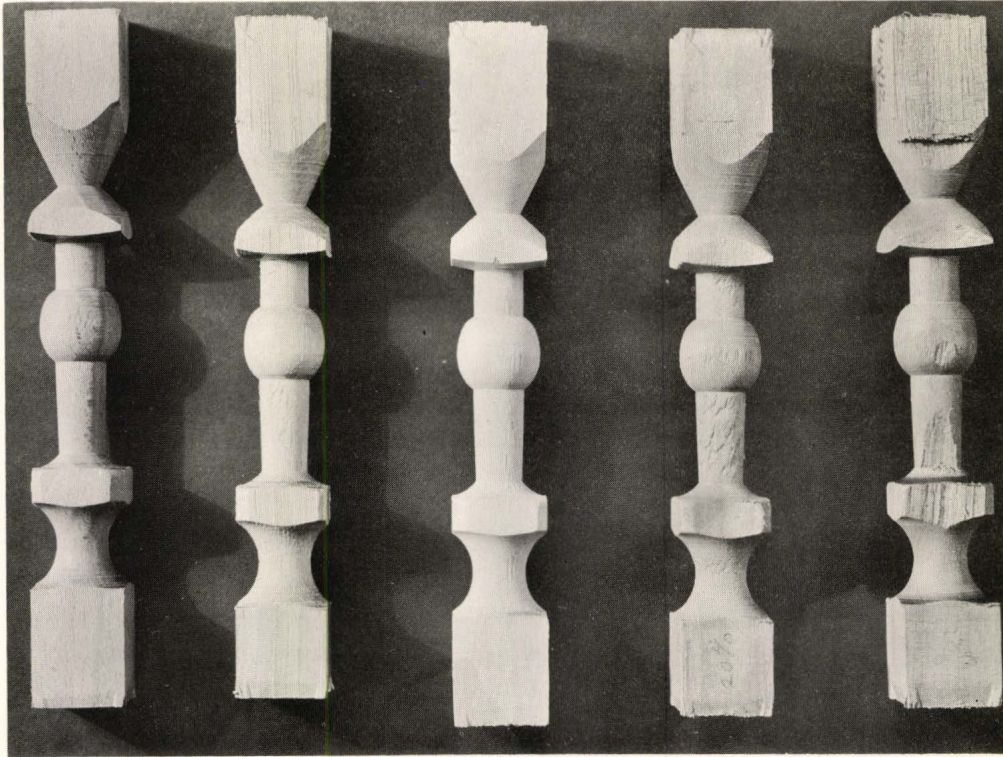


Figure 2.--Hardwood samples used in the Forest Products Laboratory turning tests. Note the range in quality of work obtained under various conditions.

sharp profile. Turners believe woods other than beech are better for complicated turnings, for those with pronounced profile, or those with delicate design. Small articles, such as beads, where high production rate on an automatic lathe is essential, can best be made of other woods. Beech is considered difficult to bore, but no more so than other dense woods. Out-of-round shrinkage is undoubtedly related to seasoning deficiency. Generally, however, if the right type of turning is chosen and if the machine is adjusted properly, as good turnings can be made from beech as from other woods.

#### Lathe Type And Use

The type of lathe used in turning appears to have an important effect on the quality of turnings. Best results are obtained with a back-knife lathe for some reason as yet not determined. The variety lathe gives a good yield of ac-

ceptable turnings but, in general, turners rate the performance on this latter machine somewhat lower than on the former type. Research at the Michigan State College indicates that whereas 100 percent acceptable turnings were obtained from beech, birch, and maple on a back-knife lathe, 98, 98, and 94 percent, respectively, were obtained on a variety lathe.

Another factor to be considered is the relationship of acceptable turnings to high lathe speeds (over 3,500 r.p.m.) and low (under 3,500 r.p.m.). Most operators indicate that speed is not too important and they get acceptable turnings at both high and low speeds. Most agree, however, that the best turnings are produced at high speeds.

#### Moisture Content

The turnability of beech is related not only to the type of lathe used, but also to the moisture content of the stock. Table 2 cites the results of moisture content experimental work at the Forest Products Laboratory and Michigan State College.

Table 2.--Effect of moisture content on quality  
of turnings

Ratings given by	Acceptable Turnings	
	Dry	Green
	<u>Percent</u>	<u>Percent</u>
Forest Products Laboratory	96	99
Michigan State College	98	100

Results at Michigan State showed that on a back-knife lathe there was little differences between beech, green, at 12 percent and at 6 percent moisture content. Experimenters found a slight difference on a variety lathe, the green working a little better. This corresponds with the research results of the Forest Products Laboratory.

The industry, however, reports that beech turns poorly when green. Although most Service Bureau members' experience is in line with dry beech experimental results cited, less than half indicated acceptable performance with beech in the



green state. This rating may reflect not so much the actual quality of the turnings as they come off the lathe, as their subsequent action when they shrink out-of-round, warp, end-check, and surface-check in drying.

### Boring

Many turned articles must be bored, and in considering the suitability of wood for turning, ease of boring is important. To begin with, some operators indicate that beech is no more difficult to handle than yellow birch or maple. This is as it should be, because the specific gravities of these three woods are very similar. Still, some operators report that the holes in beech do not keep their dimension. Again, this dimensional problem is undoubtedly related back to poor seasoning or storage conditions.

### Finishing

Another important aspect of the turning business is finishing. The general opinion is that beech finishes acceptably. There have been complaints that beech does not take baked or transparent finishes well, or does not take stain uniformly. Solving these problems seems a matter of good technique. One turner advised that he had resolved his finishing difficulties by working closely with the supplier of his finishing materials.

## SUMMARY

It is generally concluded that the small turned articles and novelties for which beech is suitable are small handles, bowls, beads, dowels ( $\frac{1}{2}$  to  $\frac{1}{8}$  inch in diameter), broom and mop handles, toys, chair turnings, table legs, baseball bats, and fish pole handles. Many turners do not consider it suitable for delicate and complicated turnings. Because of shrinking out-of-round, there has been some bad experience with it for such items as screw-driver handles and knobs that require a baked enamel finish. This shrinkage situation also makes it difficult to produce beech turnings that have to be held to close dimension. In dowels there is some tendency towards warpage. These points appear to be related to moisture content. And beech has a "bulge"; it turns as well dry as green, so that most difficulties would be eliminated by adequate drying--down to 8 percent.

Beech does shrink more tangentially than other woods (11.4 percent) (4), but the difference is not great enough between species to be critical. Some years ago, it was considered impractical to produce dry beech turning stock. Attempts to do so resulted in very low yields (primarily because of surface-checking), which offset any apparent differential in original price between beech, maple, and birch, the comparable turning woods. A differential of at least 20 to 30 percent per thousand, grade for grade, was required to compensate for the losses. Today, however, modern drying techniques make it possible to season beech to moisture contents at which the dimensional changes are minimized, without excessive seasoning degrade. For information on this subject readers are referred to Beech Utilization Series Paper No. 11, "Seasoning of Beech" (1).

Thus, it appears that, in the turning field, beech is by no means an unwanted child. With proper seasoning of turning stock, properly adjusted equipment, and a selection of items to which it is naturally adapted, beech should be, if not the king of turning woods, at least the queen.

## LITERATURE CITED

1. Baker, Gregory, and McMillen, John M.  
1955. SEASONING BEECH LUMBER.  
Northeast. Tech. Com. Util. Beech and North-  
east. Forest Expt. Sta., Beech Util. Ser. 11.  
22 pp., illus.
2. Betts, H. S.  
1945. AMERICAN BEECH.  
U. S. Forest Serv., Amer. Woods Ser. 8 pp., il-  
lus. Washington.
3. Davis, E. M.  
1942. MACHINING AND RELATED CHARACTERISTICS OF SOUTH-  
ERN HARDWOODS. U.S. Dept. Agr. Tech. Bul. 824.  
42 pp., illus.
4. Markwardt, L. J., and Wilson, T. R. C.  
1935. STRENGTH AND RELATED PROPERTIES OF WOODS GROWN  
IN THE UNITED STATES. U. S. Dept. Agr. Tech.  
Bul. 479. 99 pp., illus.
5. McIntire, S. H.  
1954. THE MACHINING OF BEECH.  
Northeast. Tech. Com. Util. Beech and North-  
east. Forest Expt. Sta., Beech Util. Ser 9.  
9 pp.
6. Merrick, Gordon D.  
1951. WOOD USED IN MANUFACTURE--1948.  
U. S. Forest Serv., Forest Resource Rpt. 2. 66  
pp. Washington.
7. Panshin, A. J.  
1947. THE MICHIGAN WOOD TURNING INDUSTRY--STATUS AND  
OUTLOOK FOR EXPANSION. Forest Prod. Res. Com.,  
Michigan Dept. of Econ. Development. 27 pp.



(CONTINUED FROM INSIDE OF FRONT COVER)

- \* Chemistry and chemical utilization of beech.
- \* Silvicultural characteristics of beech.  
Availability and supply of beech.  
Present markets and uses for beech.
- \* Logging beech and specifications for products.
- \* Seasoning beech lumber.
- \* Storage of beech logs and bolts.
- \* Machining of beech.
- \* Milling of beech.
- \* Gluing techniques for beech.
- \* Steam-bending of beech.  
Preservative treatment of beech.
- \* Beech for flooring.  
Beech for furniture.
- \* Beech for turned products and novelties.
- \* Beech for veneer and plywood.
- \* Beech for fuel and charcoal.
- \* Beech for crossties.
- \* Beech for containers.
- \* Pulping and defiberization of beech.
- \* Rough construction on the farm with beech.

The Northeastern Station acknowledges gratefully the effort being devoted to these problems by the many agencies and individuals who are cooperating in this project. Among the leaders in it are David B. Cook, New York State Conservation Department; Claude Bell, U.S. Forest Products Laboratory; A. H. Bishop, State University of New York, College of Forestry; and Fred Wangaard, Yale University School of Forestry. These men, along with Fred C. Simmons and C. R. Lockard of the Northeastern Station, comprise the working committee that is directing and coordinating the project.

The information gathered in this widespread cooperative project should be of great use to the wood-using industries of the regions where the wood of American beech is available.

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